Perchlorate and Food

The California Environmental Protection Agency, Office of Environmental Health Hazard Assessment (OEHHA) has issued a final Public Health Goal (PHG) for perchlorate in drinking water. State law requires OEHHA to account for perchlorate exposure from non-water sources (including food) in setting its PHG. The PHG indicates that 6 ppb of perchlorate in drinking water would not pose a significant health risk to the most vulnerable populations (pregnant women and young children) even if a person were also ingesting perchlorate in lettuce, milk and other foods where perchlorate has been detected. In calculating the PHG, OEHHA used recent data on levels of perchlorate in certain foods as an indicator that Californians may receive perchlorate from some foods. The following information is provided on perchlorate and the food supply.

1. What is perchlorate?

A: Perchlorate is a man-made salt (i.e., ammonium, potassium or sodium salt) that dissociates to form a relatively stable anion ($ClO4$). Perchlorate is also naturally occuringin some specific situation, e.g. Chilean nitrate deposits. Perchlorate is highly soluble in water, non-volatile, and not affected by pH and temperature. As an oxidant, perchlorate is kinetically non-labile. Natural chemical reduction in the environment is not expected to be significant. Therefore, perchlorate may persist for many decades under typical underground water and surface water conditions.

2. What are the sources of perchlorate contaimination?

A: Ammonium perchlorate (NH_4ClO_4) has been used as the principal component in rocket fuel, highway flares and fireworks. It is also used in munitions. Solid rocket fuel containing ammonium perchlorate has a finite shelf life, and this rocket fuel had to be periodically flushed from missiles and rockets and replaced with a fresh supply. This periodic flushing and replacement of rocket fuel since the 1950s has generated substantial quantities of waste perchlorate requiring disposal. Some of this waste perchlorate has leached into soil and aquifers used for drinking or irrigation.

Other minor sources include the use of fertilizers imported from Chile and the industrial use of perchlorate salts as an additive in lubricating oils, tanning and finishing leather, and paints, and in analytical chemistry laboratories.

3. What geographical areas are known to be contaminated with perchlorate?

A: Most areas where perchlorate has been detected are associated with facilities that have manufactured, tested, or disposed of solid rocket fuels, explosives, fireworks, and highway flares. The U.S. Environmental Protection Agency (U.S. EPA) has identified such facilities in 39 states. Thus, perchlorate contamination is a national issue.

In California, documented areas of contamination include:

1) Eastern Sacramento County, near Aerojet General Corporation's facility near Rancho Cordova,
2) Placer County, at an explosive manufacturing facility near Lincoln,
3) Santa Clara County, at United Technologies and Olin Corp.
4) San Benito County, at the Whittaker Ordinance Facility near Hollister,
5) Los Angeles County, at an Aerojet Facility in Azusa, Whittaker–Bermite site in Santa Clarita and the Jet Propulsion Laboratory in Pasadena,
6) San Bernardino County, at Lockheed Propulsion Company and near a defunct fireworks site near Rialto,
7) Some parts of Riverside County.
8) Lower Colorado River.

Ongoing perchlorate contamination of the Colorado River originates from an ammonium perchlorate manufacturing site near Las Vegas, Nevada. As a result of this ongoing contamination in Nevada, the water of the lower Colorado River has been reported to contain from 5 to 9 parts per billion (ppb, ug/liter) of perchlorate. The Colorado River supplies drinking water to much of Southern California. Colorado River water is also used for irrigating food crops in almost one million acres of farmland in California and Arizona.

4. How is perchlorate getting into our food and what can be done?

A: There are a several locations in the state where groundwater has been contaminated by rocket testing, and fireworks and flare manufacturing facilities. Perchlorate enters food through contaminated water that is used to grow crops used for human food or is used as a water source for livestock or animal feed.

The Colorado River, which provides a significant proportion of water used for crop irrigation in Southern California, has been contaminated with low levels of perchlorate for many years. That contamination comes from by an ammonium perchlorate manufacturing plant in Henderson, Nevada, near Lake Mead.

U.S. EPA is overseeing cleanup work at the Nevada facility that is responsible for releases of perchlorate into the Colorado River. In the last two years, clean up activities have significantly reduced the input into the Colorado River.

5. What are the health effects of perchlorate?

A: Perchlorate can limit the uptake of iodide, an essential nutrient, by the thyroid gland. At high exposures perchlorate can disrupt the production of thyroid hormones that regulate metabolism and growth. Pregnant mothers and their fetuses are more susceptible to health effects from reduced production of thyroid hormones. Iodide inhibition in the mother's thyroid can reduce the production of thyroid hormones needed for the fetus' brain development. In addition, perchlorate can cross the placenta and affect the fetal thyroid gland directly, and also block the beneficial transport of iodide

across the placenta to the fetus. Infants exposed to perchlorate could be similarly affected. Perchlorate may also affect the beneficial uptake of iodide into breast milk.

6. I've read in the paper that perchlorate has been found in some vegetables and milk. Should a pregnant woman or child stop using these products?

A: No. Newspaper articles and some scientific studies have pointed out that irrigation water containing perchlorate may result in low levels of perchlorate in some foods. The scientific studies that have found perchlorate in lettuce and in milk were limited in scope and cannot be applied to all foods in all locations. Further studies are under way to quantify perchlorate in various types of food.

At this point, there is not enough information to suggest that eating foods with low levels of perchlorate poses a health risk. DHS continues to recommend that all people, including children and pregnant women, eat a balanced diet that includes a variety of fresh fruits and vegetables, as well as dairy products, and one that is low in trans and saturated fats.

7. What are the public health goals (PHG) and allowable levels of perchlorate in drinking water and food crops?

A: In accordance with Health and Safety Code Section 116293 (SB1822, Sher, Statutes of 2002), the Office of Environmental Health Hazard Assessment (OEHHA) hereby publishes the final Public Health Goal (PHG) for perchlorate in drinking water. The PHG is also published in accordance with a court order that requires publishing a final PHG by March 12, 2004. OEHHA has completed a technical support document that provides the scientific basis for the PHG. The draft document has undergone a public workshop and two public review and comment periods in fulfillment of the requirements of Health and Safety Code, Section 116365 and Section 57003 (SB 1082). It has been peer reviewed twice by the University of California and also by the U.S. Environmental Protection Agency (U.S. EPA). The final document incorporates changes in response to peer review and public comments. It is available at (http://www.oehha.ca.gov/water/phg/index.html).

The PHG for perchlorate is a drinking water goal only. The PHG is 6 ppb (parts per billion) and there are no existing state or federal drinking water standards. The current detection level for perchlorate in drinking water is 4 ppb. This 4 ppb level has been the action level for perchlorate in California, and is being met by most municipal water systems.

The support document estimates the level of the chemical in drinking water that would pose no significant health risk to individuals, including sensitive populations, consuming the water on a daily basis over a lifetime. PHGs represent health-protective goals based solely on public health considerations and are developed based on the best available data in the scientific literature. The document provides the scientific basis for the California Department of Health Services (DHS) to establish a primary drinking water

standard (state maximum contaminant level, or MCL). By law, DHS will consider economic factors and technical feasibility in setting the MCL. The PHG also provides relevant information on the chemical to federal, state, and local public health officials.

The National Academy of Sciences (NAS) is conducting an evaluation of U.S. EPA's 2002 Draft Toxicological and Risk Characterization for Perchlorate. This is an important undertaking that may help guide efforts to study the health effects of perchlorate. When that evaluation is completed, OEHHA will carefully review the NAS conclusions and will revise the PHG as necessary (Health and Safety Code Section 116365(e)(1)).

Studies are underway to quantify perchlorate levels in various food types. DHS has indicated that based on a review of current research data, there is no imminent health threat from perchlorate in food that would require a change in diet.

8. Some studies report perchlorate results on a "wet weight basis" (or "as consumed"), while others report their results on a "dry weight basis." Can these results be compared?

A: Scientists generally report data on perchlorate in vegetation on a dry weight basis to allow comparison within a single study or among different studies. Moisture content of lettuces varies from 92 to 96 percent depending upon variety (e.g., romain, iceberg, butterhead, etc.), harvesting time (e.g., winter, spring, summer, or fall), processing, packaging, and storage conditions.

The data presented on a dry weight basis would need to be converted back to a "wet weight" value in order to provide an estimate of perchlorate intake by consumers.

The following formula can be used to convert the dry weight based perchlorate concentration to the wet weight based perchlorate concentration that is more helpful in assessing dietary intake:

$$P \times (100 - M)/100 = Q$$

Where,

- P is the perchlorate in food on dry weight basis (i.e., micrograms of perchlorate per kilogram of food (µg/kg))
- M is the percent moisture of the food—this can be determined in the laboratory, or the average value of a food can be obtained from the USDA website: http://warp.nal.usda.gov/fnic/foodcomp/Data/SR14/wtrank/sr14a255.pdf
- Q is the perchlorate concentration of the food on a wet weight basis (µg/kg).

For example, if a particular lettuce is reported to contain 200 µg/kg perchlorate on a dry weight basis, and if it has 96% moisture, a wet-weight concentration of 8 µg/kg perchlorate is derived [200 x (100-96)/100 = 8]. This value of 8 µg/kg then can be used to estimate perchlorate intake, using an appropriate serving size for lettuce. If a serving

size of lettuce weighs 100 grams (or 0.1 kg), then the perchlorate intake per serving would be 0.8 µg (8 µg/kg x 0.1 kg = 0.8 µg).

9. Why doesn't DHS have more data on perchlorate in all types of food in California?

A: Laboratory methods for assessing perchlorate at low concentrations in water became available in 1997 and are reasonably well validated. Developing analytical methods for perchlorate in foods is much more complicated since the analysis must deal with the complex and varied substances in food that can interfere with the analytical procedure.

In recent months, DHS has worked with the United States Food and Drug Administration (FDA) to develop and validate methods for detection of perchlorate in lettuce. The testing methods continue to improve allowing for detection of perchlorate in food products at much lower levels. Validated laboratory methods for assessing perchlorate in many other foods are still under development. Several university laboratories are also working on improving food analyses.

DHS will continue to work with United States Environmental Protection Agency (EPA), the FDA, and university laboratories to evaluate and validate improved laboratory methods for the detection of perchlorate in foods.

DHS also encourages the agricultural community to work with university and commercial laboratories to help determine if and how much perchlorate is present in produce and dairy products in various regions around the state.

10. What additional efforts are state or federal agencies making to assess the risk of perchlorate in food?

A: Risk assessment data on perchlorate in water developed by OEHHA will serve as a starting point for the assessment of potential risks associated with perchlorate in food. DHS is continuing to work with government and university researchers in identifying the presence and any risk of perchlorate in food products. FDA is currently conducting a national survey for the presence of perchlorate in lettuce and bottled water. Samples of lettuce and bottled water from California will be tested as part of this survey. Collection and analysis of other food items will begin as soon as appropriate methods are developed.

11. Will California establish tolerances for perchlorate in food?

A: Before any decisions are made on initiating a regulatory approach, the levels of perchlorate in various food items must be determined so that DHS can assess the extent of any possible exposure. This will be DHS' priority in the immediate future

Because perchlorate contamination of foods is a national issue, DHS will continue to work with EPA and FDA to evaluate the risks posed by different food commodities from perchlorate within and outside of California.

12. Where can I get additional information on perchlorate in food?

A: Return to the DHS Food and Drug Branch web site (http://www.dhs.ca.gov/fdb for the latest information on perchlorate in California foods, The following FDA website can also provide additional information on perchlorate in foods at http://www.cfsan.fda.gov/~dms/clo4qa.html and the EPA website at http://cfpub.epa.gov/ncea/cfm/perch.cfm?ActType=default

For information on perchlorate in drinking water in California, please visit the following website at http://www.dhs.ca.gov/ps/ddwem/chemicals/perchl/actionlevel.htmand http://www.oehha.ca.gov/water/phg/perchphg31204.html

IS 5-13-04 1015hrs